

Claims

- [c1] 1. A hollow filament having sufficient openings therein for said hollow filament to substantially fill with liquid.
- [c2] 2. A hollow polyester filament having sufficient openings therein for said hollow filament to substantially fill with a liquid selected from the group consisting of water, water-based solutions, and water-based suspensions.
- [c3] 3. A hollow filament according to Claim 1 consisting essentially of polyethylene terephthalate.
- [c4] 4. A staple fiber cut from the hollow filament of Claim 1.
- [c5] 5. A staple fiber according to Claim 4 and having a length sufficient to exhibit fiber properties.
- [c6] 6. A staple fiber according to Claim 4 and having a length sufficient to support meniscus of water at each end thereof.
- [c7] 7. A staple fiber according to Claim 4 having a length of between about one-quarter inch and two inches.
- [c8] 8. A nonwoven fabric formed from a plurality of staple fibers according to Claim 4.
- [c9] 9. A nonwoven fabric formed from a plurality of staple fibers according to Claim 7.
- [c10] 10. An absorbent structure that includes a nonwoven fabric according to Claim 9.
- [c11] 11. A hollow filament according to Claim 1 wherein both said filament and its hollow portion have respective circular cross section.
- [c12] 12. A hollow filament according to Claim 1 wherein said filament has a circular cross section and said hollow portion has a non-circular cross section.
- [c13] 13. A hollow filament according to Claim 1 wherein said filament has a non-

circular cross section and said hollow portion has a circular cross section.

- [c14] 14. A hollow filament according to Claim 1 wherein said filament has a non-circular cross section and said hollow portion has a non-circular cross section.
- [c15] 15. A hollow staple fiber consisting essentially of polyethylene terephthalate and having sufficient openings therein for said staple fiber to substantially fill with water.
- [c16] 16. A polyester filament having a moisture absorption capability of between about 10 and 30 percent by volume.
- [c17] 17. A filament according to Claim 16 consisting essentially of polyethylene terephthalate.
- [c18] 18. A hollow filament according to Claim 16.
- [c19] 19. A hollow filament according to Claim 16 wherein both said filament and its hollow portion have respective circular cross section.
- [c20] 20. A staple fiber cut from the filament of Claim 16.
- [c21] 21. A nonwoven fabric formed from the staple fiber of Claim 20.
- [c22] 22. An absorbent structure that includes a nonwoven fabric according to Claim 21.
- [c23] 23. A hollow filament according to Claim 18 and having an asymmetric cross section.
- [c24] 24. A hollow filament according to Claim 23 wherein both said filament and its hollow portion have respective circular cross section and said hollow portion is not coaxial with said filament..
- [c25] 25. A staple fiber cut from the filament of Claim 23.
- [c26] 26. A nonwoven fabric formed from the staple fiber of Claim 25.
- [c27] 27. An absorbent structure that includes a nonwoven fabric according to Claim 26.

- [c28] 28. A staple fiber consisting essentially of polyethylene terephthalate and having a moisture absorption capability of between about 10 and 30 percent by volume.
- [c29] 29. A hollow filament having an asymmetric cross section and having sufficient openings therein for said hollow filament to substantially fill with liquid.
- [c30] 30. A hollow polyester filament having an asymmetric cross section and having sufficient openings therein for said hollow filament to substantially fill with a liquid selected from the group consisting of water, water-based solutions, and water-based suspensions.
- [c31] 31. A filament according to Claim 29 consisting essentially of polyethylene terephthalate.
- [c32] 32. A filament according to Claim 29 wherein both said filament and its hollow portion have respective circular cross sections and wherein said hollow portion is not coaxial with said filament.
- [c33] 33. A staple fiber cut from the filament of Claim 29.
- [c34] 34. A staple fiber according to Claim 33 having a length of between about one-quarter inch and two inches.
- [c35] 35. A nonwoven fabric formed from a plurality of staple fibers according to Claim 34.
- [c36] 36. An absorbent structure that includes a nonwoven fabric according to Claim 35.
- [c37] 37. A hollow staple fiber consisting essentially of polyethylene terephthalate; said staple fiber having sufficient openings therein for said staple fiber to substantially fill with a liquid; and said staple fiber and its hollow portion having respective circular cross sections and wherein said hollow portion is not coaxial with said staple fiber.
- [c38] 38. A hollow staple fiber according to Claim 37 having sufficient openings therein for said staple fiber to substantially fill with a liquid selected from the

group consisting of water, water-based solutions, and water-based suspensions.

- [c39] 39. A method of forming a highly water-absorbent polyester filament, the method comprising:
contacting a hollow polyester filament with a chemical composition in an amount and for a time sufficient to attack the hollow filament and create sufficient openings therein for the hollow filament to substantially fill with a liquid while less than an amount that would completely open or dissolve the filament.
- [c40] 40. A method according to Claim 39 comprising creating sufficient openings for the hollow filament to substantially fill with a liquid selected from the group consisting of water, water-based solutions, and water-based suspensions.
- [c41] 41. A method according to Claim 39 comprising contacting the filament with an aqueous alkali solution.
- [c42] 42. A method according to Claim 41 comprising contacting the filament with the aqueous alkali solution at an elevated temperature.
- [c43] 43. A method according to Claim 41 comprising contacting the filament with an aqueous solution selected from the group consisting of sodium hydroxide, potassium hydroxide and ammonium hydroxide.
- [c44] 44. A method according to Claim 39 comprising contacting the filament with an organic solvent for polyester.
- [c45] 45. A method according to Claim 39 comprising contacting the filament with a solvent selected from the group consisting of: benzene, esters and ketones.
- [c46] 46. A method according to Claim 39 comprising contacting the filament with a plasticizer.
- [c47] 47. A method according to Claim 39 comprising contacting a polyethylene terephthalate filament.
- [c48] 48. A method according to Claim 39 and further comprising the step(s) of

spinning the hollow filament from a melt prior to the step of contacting the filament with the attacking composition.

[c49] 49. A method according to Claim 48 comprising spinning a hollow filament with an asymmetric cross section.

[c50] 50. A method according to Claim 39 and further comprising cutting the filament into staple fibers.

[c51] 51. A method according to Claim 50 and further comprising forming a nonwoven fabric from the cut staple fibers.

[c52] 52. A method according to Claim 41 and further comprising neutralizing the filament after contacting the filament with the aqueous alkali solution.

[c53] 53. A method according to Claim 39 and further comprising the steps of:
heat setting the filament;
cutting the filament into staple fibers; and
baling the cut staple fibers;
all following the step of contacting the filament with the chemical composition.

[c54] 54. A method of forming a highly absorbent synthetic polymer filament, the method comprising:
contacting a hollow polymeric filament with an organic solvent for the polymer in an amount and for a time sufficient to attack the hollow filament and create sufficient openings therein for the hollow filament to substantially fill with a liquid while less than an amount that would completely open or dissolve the filament.

[c55] 55. A method according to Claim 54 comprising creating sufficient openings for the hollow filament to substantially fill with a liquid selected from the group consisting of water, water-based solutions, and water-based suspensions

56. A method according to Claim 54 comprising contacting a hollow polyester filament with the solvent.

[c56] 57. A method of forming a highly absorbent synthetic polymer filament, the method comprising:

mechanically cracking a hollow polymeric filament until the filament is sufficiently open to substantially fill with a liquid.

- [c57] 58. A method according to Claim 57 comprising mechanically cracking a hollow polyester filament until the filament is sufficiently open to substantially fill with a liquid selected from the group consisting of water, water-based solutions, and water-based suspensions.
- [c58] 59. A method according to Claim 57 comprising cracking a filament that has a asymmetric cross section.
- [c59] 60. A method according to Claim 59 and further comprising the step of spinning the asymmetric filament from a melt prior to the step of mechanically cracking the filament.
- [c60] 60. A method according to Claim 59 and further comprising the step of spinning the asymmetric filament from a melt prior to the step of mechanically cracking the filament.
- [c61] 61. A method according to Claim 59 and further comprising cutting the filament into staple fiber.
- [c62] 62. A method according to Claim 61 and further comprising forming a nonwoven fabric from the staple fibers.
- [c63] 63. A method according to Claim 59 and further comprising the step of spinning the asymmetric filament prior to the step of mechanically cracking the filament.
- [c64] 64. A method according to Claim 57 and further comprising spinning the hollow filament from a melt prior to the step of cracking the filament.
- [c65] 65. A method according to Claim 64 and further comprising cutting the filament into staple fiber.
- [c66] 66. A method according to Claim 65 and further comprising forming a nonwoven fabric from the staple fibers.

[c67] 67. A method according to Claim 57 comprising cracking a filament consisting essentially of polyethylene terephthalate.

[c68] 68. A method according to Claim 57 and further comprising the steps of heat setting the filaments;
cutting the filaments into staple fiber; and
baling the cut staple fibers.

[c69] 69. A method of forming a highly absorbent polyester filament, the method comprising:
spinning an asymmetric hollow filament from a melt;
preferentially quenching the filament to create greater and lesser degrees of polymer orientation along the filament;
drawing the filament to a desired draw ratio;
heat setting the drawn filament; and
mechanically cracking a hollow polyester filament until the filament is sufficiently open to substantially fill with a liquid.

[c70] 70. A method according to Claim 69 comprising mechanically cracking the filament until the filament is sufficiently open to substantially fill with a liquid selected from the group consisting of water, water-based solutions, and water-based suspensions.

[c71] 71. A method according to Claim 69 wherein the drawing step comprises drawing the filament to degree that highly stresses the more highly oriented portions of the filament.

[c72] 72. A staple filament having a coaxial opening entirely therethrough, the filament having a length defined by the minimum length sufficient to support a meniscus of water in the coaxial opening and a maximum length at which the filament will fill entirely with a liquid selected from the group consisting of water and water-based solutions and suspensions.

[c73] 73. A staple filament according to Claim 72 wherein the maximum length is the length above which air pressure between a meniscus at each end of the filament will prevent the opening from filling entirely with the selected liquid.

- [c74] 74. A staple filament according to Claim 72 comprising polyester.
- [c75] 75. A staple filament according to Claim 72 comprising polyethylene terephthalate.
- [c76] 76. A staple filament according to Claim 72 having a length less than about one-half inch.
- [c77] 77. A staple filament according to Claim 72 having a length of about one-quarter inch.
- [c78] 78. A staple filament according to Claim 72 having a denier of between about 1 and 45.
- [c79] 79. A staple filament according to Claim 72 having a denier of between about 1 and 10.
- [c80] 80. A staple filament according to Claim 72 having a denier of between about 1 and 3.
- [c81] 81. A method of forming a highly absorbent filament comprising:
spinning a hollow filament at a denier of between about 1 and 45;
quenching the filament; and
cutting the filament into short staple fibers having a length defined by the minimum length sufficient to support a meniscus of water in the coaxial opening and a maximum length at which the filament will fill entirely with a liquid selected from the group consisting of water and water-based solutions and suspensions.
- [c82] 82. A method according to Claim 81 comprising spinning a polyester hollow filament.
- [c83] 83. A method according to Claim 81 comprising spinning the filament to a denier of between about 1 and 10.
- [c84] 84. A method according to Claim 81 comprising spinning the filament to a denier of between about 1 and 3.

- [c85] 85. A method according to Claim 81 comprising cutting the filament into staple less than about one-half inch in length.
- [c86] 86. A method according to Claim 81 comprising cutting the filament into staple about one-quarter inch in length.